6TH-ANNUAL

SPE AUTOMOTIVE COMPOSITES CONFERENCE

September 12-14, 2006

MSU MANAGEMENT EDUCATION CENTER
811 W. Square Lake Road, Troy, MI USA

COMPOSITES
EFFICIENCY, VALUE, PERFORMANCE

SOCIETY OF PLASTICS ENGINEERS
Automotive & Composites Divisions

WELCOME
FROM THE 2006 ACCE CHAIR

On behalf of the Automotive and Composites Divisions of the Society of Plastics Engineers International, welcome to the 6th-Annual ***Automotive Composites Conference and Exhibition***. This year's theme, "*Composites: Efficiency, Value, Performance*," reinforces the unique ability of polymer composites to improve all three factors in automotive design. A second theme of the conference might be *"more"* – more international, more speakers, more innovations, and more chances to learn and interact.

In a global environment of rising and ever-uncertain oil prices, a renewed focus on fuel economy is putting composites right back into the spotlight. No other materials category offers automotive designers as many options to lower mass, increase differentiation, and offer more functionality and performance. And this year's conference is replete with examples of these advantages.

So where are we offering *"more"* this year?

- **SMC is back**, and in a big way! We have a whole day of sessions dedicated to SMC, plus a few extra papers spread among other sessions highlighting recent advancements in this important material.
- **Three panel sessions**, once each day of the conference, covering *Growth in Thermoset Composites, Integrating Composites into OEM Operations*, and the important and popular OEM session, *The Future of Automotive Composites.*
- **Eight distinguished keynote speakers** providing valuable perspectives from Japan, India, and Europe, and from notable U.S. organizations like the American Plastics Council, Department of Energy, and Boeing.
- **A record number of sponsors, exhibitors, and technical papers** across multiple technologies and applications, including new sessions on *Simulation and Testing* and *Novel Composite Technologies*. Two sponsored evening receptions provide further opportunities to network and explore the latest technology on display.

Additional sessions for this year's conference include *Advances in Thermoplastic Composites, Enabling Technologies, Nanocomposites, Bio- and Natural-Fiber Composites, Structural Applications*, and *New Materials*. Authors hail from the U.K., Germany, The Netherlands, Malaysia, Japan, Australia, New Zealand, and North America, making this the most global conference dedicated to automotive composites.

This conference has become a year-round endeavor. The members of the SPE Automotive and Composites Divisions on the committee meet shortly after the conference to review participant feedback and begin planning the next year's event. Many of these volunteers have been associated with this conference for a number of years, a key reason it keeps getting better! I would like to personally thank each committee member for his / her contributions.

Of course, the conference could not exist without the support of our authors, presenters, keynote speakers, sponsors, and attendees, and I thank each of them as well. Since we are all here to learn as well as teach, I challenge each of you to seek out speakers and exhibitors in those areas that interest you and engage in a constructive dialogue about how their ideas and yours can come together to create solutions that are indeed *efficient, value creating, and high performance*.

Please enjoy the conference, and please contact any of our committee members if you have questions, need assistance, or to offer feedback to help us make next year's event even better.

Best Regards,

Dale Brosius

Dale Brosius
2006 SPE Automotive Composites Conference Chair
Quickstep Technologies Pty. Ltd.

The 2006 Planning Committee

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PANEL DISCUSSION ORGANIZERS & MODERATORS

TUESDAY
The Growth of Thermoset Composites - Benefits & Challenges

Probir Guha (Organizer)
Continental Structural Plastics

Gary Lansettle (Moderator)
Ashland Chemical / ACA Chair

Jim Bielak
Ford Motor Company

Brad Rogers
General Motors

Nippani Rao
DaimlerChrysler

Mike Siwajek, Ph.D.
Continental Structural Plastics

Tyler Hardy
Meridian Automotive Systems

Keith Bihary
MFG Companies

WEDNESDAY
Integration of Composites into OEM Vehicle Operations

Tim Dummer (Organizer)
GE Plastics

David Cole (Moderator)
Center for Automotive Research

Howard Cox
General Motors

Jim deVries
Ford Motor Company

Karl Wagner
Carbotech Composite

Rogelio Sullivan
U.S. Department of Energy

THURSDAY
The Future of Automotive Composites

Dale Brosius (Moderator, Organizer)
Quickstep Technologies

Dave Mattis
General Motors

Richard Jeryan
Ford Motor Company

Susan Yester
DaimlerChrysler

Nobuya Kawamura
Toyota Motor Company

Jeff Robbins
Meridian Automotive Systems

Tuesday, September 12, 2006

	AUDITORIUM	AMPHITHEATER 101	AMPHITHEATER 102
7:00–8:30	REGISTRATION - COFFEE IN MEZZANINE *(Sponsored by AOC LLC)*		
8:30–9:30	**RIBBON-CUTTING CEREMONY; EXHIBITS OPENED by Dr. Frank Henning,** '06 SPE Composites Conference Program Vice-Chair		
	CONTINENTAL BREAKFAST SERVED - EXHIBITION AREA *(Sponsored by Bayer MaterialScience)*		
9:30–9:45	**OPENING REMARKS - Dale Brosius,** '06 SPE Composites Conference Program Chair		
9:45–10:30	**KEYNOTE SPEAKER - Dr. Michael Fisher,** American Plastics Council *Plastics are for Cars After All*		
	ADVANCES IN SHEET MOLDING COMPOUND - PART 1	ADVANCES IN THERMOPLASTIC COMPOSITES - PART 1	BIO- AND NATURAL-FIBER COMPOSITES - PART 1
10:30–11:00	**Francis Krantz** Ashland, Inc. *Advanced Laser Surface Analyzer*	**Jeroen Van Poucke** Dow Automotive *Long Glass Fiber Polypropylene Technology for Automotive Applications*	**Angela Harris** Ford Motor Company *Injection Molded Polylactide (PLA) Composites for Automotive Applications*
11:00–11:30	**Robert Seats** Ashland, Inc. *Tough, Low Mass SMC Development for Transportation Applications*	**Tim VanAst** Ticona Engineering Polymers *Beyond Polypropylene - LFRT Materials for Structural, Conductive and Specialty Applications*	**Johanne Denault** National Research Council Canada *Poly(lactic acid) Nanocomposites: Fabrication, Microstructure & Performance*
11:30–12:00	**Jim Bono** Continental Structural Plastics *SMC Consistency Test Methods-Viscosity Methods*	**Paul Koch** Penn State University – Erie *Control of Moisture & Volatile Organic Compounds by Sorbent-Loaded Composites*	**Cynthia Flanigan** Ford Motor Company *Use of Agricultural Materials In Flexible Polyurethanes for Automotive Applications*
12:00–1:00	LUNCH & EXHIBITS - EXHIBITION AREA/DINING ROOM *(Sponsored by Comusa)*		
1:00–1:30	**KEYNOTE SPEAKER - Avinash Salelkar,** TATA Consultancy Services Ltd. *Potential & Benefits of India Sourcing: An Automotive Industry Perspective*		
	ADVANCES IN SHEET MOLDING COMPOUND - PART 2	ADVANCES IN THERMOPLASTIC COMPOSITES -PART 2	BIO- AND NATURAL-FIBER COMPOSITES -PART 2
1:30–2:00	**Francis Krantz** Ashland, Inc. *FACTS™, A "Flow Analysis Cure Time System" for Fiber Reinforced Thermoset Plastics*	**Eric Lee** PlastiComp LLC *Pushtrusion™ New Direct In-Line Compounding Technology - Integrating New Technology with State-of-the-Art Production Systems*	**Kim Pickering** University of Waikato, New Zealand *The Use of Fungal Treatment for Modification of Industrial Hemp Fibre for Use in Composites*
2:00–2:30	**Steve Hardebeck** Reichhold *Novel Composite Materials for Demanding Automotive Applications*	**Jason Lipke** Ticona Engineering Polymers *Advanced Integrated Door Systems - Providing Performance-Driven Solutions for Material Selection & Integration*	**Gareth Beckermann** University of Waikato, New Zealand *Hemp Fibre Reinforced Polypropylene Composites: Effect of Fibre Treatment and Coupling Agent on Composite Strength and Fibre/Matrix Interfacial Bonding*
2:30–3:00	**Hamid Kia** General Motors *New Developments in Powder Priming of SMC*	**Harri Dittmar** Quadrant Plastic Composites AG *New Composites Solutions for Automotive Underbody Systems*	**Johanne Denault** National Research Council Canada *Wood & Flax Fibre Polyolefin Composites*
3:00–3:30	**Dr. Mike Siwajek** Continental Structural Plastics *The SMC Consistency Program - A Technique for Data Driven Improvement of Product Quality*	**Manfred Brűmmer** Dieffenbacher North America *New Generation of Hydraulic Presses for Efficient LFT-D Part Production*	**Manjusri Misra** Michigan State University *Current Status of High Volume Production of Environmentally Friendly Multifunctional Biocomposites: An Overview (oral only)*
3:30–4:00	COFFEE BREAK & EXHIBITS - EXHIBITION AREA *(Sponsored by the RTP Company)*		
4:00–5:00	**PANEL DISCUSSION -** *The Growth of Thermoset Composites - Benefits & Challenges,* Moderator: **G. Landsettle**		
5:00–5:30	**KEYNOTE SPEAKER - Dr. Jeff Helms,** Ford Motor Company *Automotive Thermoset Composites - Where We've Been, Current Status and Path Forward*		
5:30–7:30	NETWORKING RECEPTION - EXHIBITION AREA *(Sponsored by the Automotive Composites Alliance)*		

WEDNESDAY, SEPTEMBER 13, 2006

	AUDITORIUM	AMPHITHEATER 101	AMPHITHEATER 102
7:00–8:00	CONTINENTAL BREAKFAST SERVED & EXHIBITS - EXHIBITION AREA *(Sponsored by Total Industries)*		
8:00–8:30	**KEYNOTE SPEAKER - William Abbatt, Esq.,** Brooks Kushman P.C. *Intellectual Property Protection*		
	NEW COMPOSITE MATERIALS AND PROCESSING - PART 1	STRUCTURAL COMPOSITE APPLICATIONS - PART 1	ENABLING TECHNOLOGIES - PART 1
8:30–9:00	**Martin Starkey** Gurit *OEM Quality CFRP Parts*	**Dave Rocco** Bayer MaterialScience LLC *A Modular Automotive Roof System Design Concept Based on Polyurethane Composite Technology*	**Jacqueline Ayotte** Ticona Engineering Polymers *Fiber Length Measurement in LFRT Materials: Using Automated Image Analysis*
9:00–9:30	**Brett Weber** Bulk Molding Compounds Inc. *BMC - Taking Automotive Composites to a New Dimension*	**Paolo Feraboli** University of Washington *Carbon Fiber Composites for Improved Performance of the Murcielago Roadster*	**Paul Stassen** AddComp *Stabilisation of Polymer Matrix Polypropylene in LFT & New Directions*
9:30–10:00	**Jim Riley** Bayer MaterialScience LLC *New Developments in PUR Composite Spray Molding PUR-CSM Technology for Multiple Processes*	**Craig Dlugos** Ticona Engineering Polymers *Material Selection for Front-End Carriers*	**Jose Feigenblum** RocTool *Tool Surface Heating Technology - Electromagnetic Transfer between an Inductor and an Electrical Conductive Material Conducting Body of Electricity*
10:00–10:30	COFFEE BREAK - EXHIBITION AREA *(Sponsored by Gurit)*		
	NEW COMPOSITE MATERIALS AND PROCESSING - PART 2	STRUCTURAL COMPOSITE APPLICATIONS - PART 2	ENABLING TECHNOLOGIES - PART 2
10:30–11:00	**James Fagan** General Electric Plastics *EMI Shielding Solutions Using Stainless Steel Filled Thermoplastic Composites*	**John Owens** General Motors *Design, Fabrication & Testing of a Composite Side Door for a Mid-Size SUV*	**Boney Mathew** Mathson Industries, Inc. *Method of Assembling a Vehicle and Integrated Composite Roof Module Technology - Paradigm Shift in Automotive Vehicle Assembly*
11:00–11:30	**Andrew D'Souza** 3M Company *Innovative, High Strength Glass Microspheres for Lightweight Injection Molded Plastics & Composites*	**Paolo Feraboli** University of Washington *Toward the Development of a Test Method for Characterizing the Energy Absorption of Composite Materials*	**Greg Gormley** ConverTec Corporation *Non-destructive Testing the Integrity of Helicopter Blades Utilizing a Unique Corona Beam Technology (oral only)*
11:30–12:00	**Frank Henning** Dieffenbacher GmbH *SMC Premium Class A Parts - Innovation in Process Technology*	**Hannes Fuchs** Multimatic Engineering Services Group *Design and Structural Performance Assessment of a Composite Intensive Passenger Vehicle*	**Olivier Guillermin** Vistagy, Inc. *Enabling Design Innovation in Automotive Composite Applications*
12:00–1:00	LUNCH & EXHIBITS - EXHIBITION AREA/DINING ROOM *(Sponsored by DuPont Automotive)*		
1:00–1:30	**KEYNOTE SPEAKER - Dr. Rob Backhouse,** McLaren Automotive *Mercedes Benz SLR McLaren - A Step Towards Affordable CFRP Structures*		
	NEW COMPOSITE MATERIALS AND PROCESSING - PART 3	STRUCTURAL COMPOSITE APPLICATIONS - PART 3	ENABLING TECHNOLOGIES - PART 3
1:30–2:00	**Kjelt van Rijswijk** Delft University of Technology *Reactively Processed Polyamide-6 Structural Composites for Automotive Applications*	**Will Chan** Sparta Composites *Non Class-A Composite Components for the Current North American Automotive OEM Environment (oral only)*	**Paul Schuch** Robotic Production Technology *Improving Productivity & Safety with Robotic Trimming*
2:00–2:30	**Derek Buckmaster** GE Plastics *HPPC: the Development of a Thermoplastic Solution for Automotive Horizontal Body Panels*	**Ed Wenzel** Delphi Corporation *Hybrid Composite Instrument Panel Cross Car Beam (oral only)*	**Ed Pilpel** Polystrand *Continuous Fiber Thermoplastic Composites Impact on the Composite Industry*
2:30–3:00	COFFEE BREAK - EXHIBITION AREA *(Sponsored by Azdel, Inc.)*		
3:00–3:30	**KEYNOTE SPEAKER - Rogelio Sullivan,** U.S. Department of Energy – Materials Technologies Group, FreedomCAR Project *Opportunities for Automotive Composites*		
3:30–5:00	**Panel Discussion -** *Integrating Composites into OEM Vehicle Operations - Technical & Economic Issues & Opportunities,* Moderator: **D. Cole**		
5:00–7:00	NETWORKING RECEPTION - EXHIBITION AREA *(Sponsored by GE Plastics)*		

Thursday, September 14, 2006

	AUDITORIUM	AMPHITHEATER 101	AMPHITHEATER 102
8:00–9:00	CONTINENTAL BREAKFAST SERVED & EXHIBITS - EXHIBITION AREA *(Sponsored by Sparta Composites)*		
9:00–9:30	**KEYNOTE SPEAKER - Nobuya Kawamura,** Toyota Motor Corporation *Carbon Fibre for Automotive Applications: Who's Willing to Do What to Make the Difference?*		
	SIMULATION & TESTING OF COMPOSITE MATERIALS - PART 1	NANOCOMPOSITES - PART 1	NOVEL COMPOSITE TECHNOLOGIES - PART 1
9:30–10:00	**Bronwyn Fox** Deakin University, Geelong, Australia *Finite Element Modeling of Composite Tubular Crash Structures With an Explicit Code*	**Hiroyuki Fukushima** Michigan State University *Multifunctional Polypropylene Nanocomposites Reinforced with Exfoliated Graphite Nanoplatelets (xGnP) (oral only)*	**Fred Deans** Azdel, Inc. *High Performance Thermoplastic Composites (oral only)*
10:00–10:30	**Thomas Brimhall** Altair Engineering *Measurement of Static and Dynamic Friction Energy Absorption in Carbon/Vinyl Ester Composite*	**Patricia Tibbenham** Ford Motor Company *Developing Polymer Nanocomposites for Automotive Applications*	**HansJoachim Studt** Collano Xiro GmbH *Innovative Use of Thermoplastic Film Adhesives in Automotive Airbags*
10:30–11:00	**Thomas Brimhall** Altair Engineering *Dynamic Energy Absorption Modes of Braided Carbon/Vinyl Ester Composite Crush Tubes*	**Paul Kennedy** Nylon Corporation of America *Nylon Nanocomposite (nanoSEAL™) for Improved Fuel Permeation Performance*	**Elaheh Ghassemieh** University of Sheffield, UK *Application of Fibre Assemblies as Damping Elements in Automotive Industry*
11:00–11:30	COFFEE BREAK - EXHIBITION AREA *(Sponsored by Johns Manville)*		
	SIMULATION & TESTING OF COMPOSITE MATERIALS - PART 2	NANOCOMPOSITES - PART 2	NOVEL COMPOSITE TECHNOLOGIES - PART 2
11:30–12:00	**Peter Foss** General Motors *Creep and Fatigue of Long Glass Reinforced Polypropylene Compounds*	**Tim Patterson** Noble Polymers *Forte: Latest Developments in Noble's Breakthrough Product Line (oral only)*	**Barbara Pause** Textile Testing & Innovation, LLC *New Textile Composites with Thermo-Regulating Properties for Automotive Interior Applications*
12:00–12:30	**Uday Vaidya** University of Alabama Birmingham *Design and Process Simulation of Long Fiber Thermoplastic Battery Box Door for Mass Transit Application (oral only)*	**Andrew Rich** Nanocyl SA *Carbon Nanotubes: An Additive with Multifunctional Properties & Current Commercial Applications*	**David Smith** Dpi Technology Consultants Inc. *A Novel Organic Fiber for Fiber Reinforced Structural Composites*
12:30–1:30	LUNCH & EXHIBITS - EXHIBITION AREA/DINING ROOM *(Sponsored by Ticona Engineering Polymers)*		
1:30–2:00	**KEYNOTE SPEAKER - James Griffing,** Boeing Commercial Airplanes *787 Dreamliner: Progress on Many Fronts*		
2:00–3:30	**PANEL DISCUSSION -** *OEM Panel on Future of Automotive Composites,* Moderator: **D. Brosius**		
3:30–3:45	CLOSING REMARKS - **Dale Brosius,** '06 SPE Composites Conference Program Chair		

PRESENTATIONS

KEYNOTE SPEAKERS

PLASTICS ARE FOR CARS AFTER ALL

Dr. Michael Fisher
American Plastics Council
What would it take to think proactively, globally, and cooperatively about how lightweight plastics, plastic composites, and plastic-metal hybrid materials could emerge as the materials of choice by 2020 to balance styling, safety, energy demand, and environmental performance on passenger vehicles? The list is not short and not trivial, but a roadmap exists to help define challenges and opportunities for both the public and private sectors.

POTENTIAL & BENEFITS OF INDIA SOURCING: AN AUTOMOTIVE INDUSTRY PERSPECTIVE

Avinash Salelkar
Tata Consultancy Services Ltd.
India presents new opportunities as a market and as a source. More automotive manufacturers are turning to India to source engineering services & components. The growing Indian automotive industry is all set to service global customers' demands. Moving into the global outsourcing model allows manufacturers to gain significant competitive advantage. However, this may necessitate a paradigm shift in strategic, tactical, and operational strategies

AUTOMOTIVE THERMOSET COMPOSITES – WHERE WE'VE BEEN, CURRENT STATUS, & PATH FORWARD

Dr. Jeff Helms
Ford Motor Company
Use of thermoset composites for automotive applications extends from structural to Class-A painted body components using materials from urethanes, RTM and SMC. The primary drivers for their use continues to be investment, part variable cost and weight, and design latitude. This talk will focus on SMC materials with an emphasis on painted applications.

INTELLECTUAL PROPERTY PROTECTION

William Abbatt, Esq.
Brooks Kushman P.C.
Managing an intellectual property portfolio is important because it often holds significant monetary value for companies. To properly maintain and manage these assets, it is crucial that engineers be able to recognize and understand the worth IP portfolios and how to protect them.

MERCEDES BENZ SLR MCLAREN - A STEP TOWARDS AFFORDABLE CFRP STRUCTURES

Dr. Rob Backhouse
McLaren Automotive
The Mercedes Benz SLR McLaren body structure is created using a number of composite manufacturing technologies. Eighty percent of the composite structure weight is processed by out-of-autoclave methods. This presentation focuses on the preforming and InCore molding process and how this component is integrated in the assembly bonding process to create the finished Body in White.

OPPORTUNITIES FOR AUTOMOTIVE COMPOSITES

Rogelio Sullivan
U.S. Department of Energy - Materials Technologies Group, FreedomCAR Project
The Department of Energy's FreedomCAR Program has made the development of low- cost automotive-grade carbon fiber its highest priority for materials research. Only carbon fiber offers the potential for greater than 50% reduction in the weight of automotive body and chassis components, producing fuel-economy improvements of up to 30%. Many of the technical hurdles that can reduce material cost and enable recycling are under development and their prospects are encouraging. The combination of technical stepping stones and market movement could provide enormous energy savings to the nation in the not too distant future.

CARBON-FIBER BASED COMPOSITES

Nobuya Kawamura
Toyota Motor Corporation
As carbon fibre usage for industrial applications has expanded, the price of carbon yarns has gradually decreased. There are still many challenges other than the material cost to overcome for carbon fibre to be accepted in the automotive industry, such as a breakthrough technology for high cycle and economical part production method.

787 DREAMLINER: PROGRESS ON MANY FRONTS

James Griffing
Boeing Commercial Airplanes
The Boeing 787 Dreamliner is a super-efficient airplane designed to use 20% less fuel for comparable missions than similar-size planes today. As much as 50% of its primary structure – including the fuselage and wing – will be made of composite materials. In addition to bringing big-jet ranges to mid-size planes, the 787 will provide airlines with unmatched fuel efficiency, resulting in exceptional environmental performance.

PRESENTATIONS

ADVANCES IN SHEET MOLDING COMPOUND

ADVANCED LASER SURFACE ANALYZER

Francis Krantz
Ashland, Inc.
A new laser surface analyzer has been developed to replace LORIA, incorporating advancements in software, electronics and imaging. Independent measurement of long term waviness, orange peel, and DOI are combined into a single unit that has demonstrated repeatability and reliability.

TOUGH, LOW MASS SMC DEVELOPMENT FOR TRANSPORTATION APPLICATIONS

Robert Seats
Ashland, Inc.
A recently developed tough, low-mass SMC for Class-A surfaces achieves a specific gravity of 1.6 with low water absorption and robustness in molding conditions. Tough, low-mass structural SMC with a specific gravity of 1.15 to 1.50 and improved mechanical properties are also presented.

SMC CONSISTENCY TEST METHODS - VISCOSITY METHODS

Jim Bono
Continental Structural Plastics
A study was completed of available viscosity test methods to minimize variation associated with testing equipment. The test methods include the current industry standard, HBT viscometers, and Brookfield's new Soft Solids Tester SST 2000, which are compared for performance in SMC matrix samples.

FACTS™, A "FLOW ANALYSIS CURE TIME SYSTEM" FOR FIBER REINFORCED THERMOSET PLASTICS

Francis Krantz
Ashland, Inc.
A new spiral flow tool designed as a compression mold is equipped with a data collection system for the dielectric (impedance) values during cure. Real-time collection of the pressure, temperature, and cure data of the composite material as it flows through the mold makes this laboratory tool an industry standard for development and quality control of compression-molding compounds.

NOVEL COMPOSITE MATERIALS FOR DEMANDING AUTOMOTIVE APPLICATIONS

Steve Hardebeck
Reichhold
A unique unsaturated polyester resin has been developed for under-the-hood applications of SMC and BMC that offers molders a lower cost option vs. traditional vinyl-ester resin systems. This resin has demonstrated excellent thermal and chemical stability in testing at elevated temperatures.

NEW DEVELOPMENTS IN POWDER PRIMING OF SMC

Hamid Kia
General Motors
Existing Class-A SMC formulas exhibit unacceptable popping behavior in powder priming bake ovens. New powder-capable Class-A formulations have been developed that feature low moisture absorption and no micro-crack outgasing. Validation is in progress on a new conductive coating that enables powder priming of SMC panels in wet conditions.

THE SMC CONSISTENCY PROGRAM - A TECHNIQUE FOR DATA DRIVEN IMPROVEMENT OF PRODUCT QUALITY

Dr. Mike Siwajek
Continental Structural Plastics
A multivariate study of the factors affecting SMC part quality was completed to identify the most significant. These included factors related to raw material, SMC compounding, molding, and finished product attributes. Noticeable reductions in scrap have been achieved on several presented case studies.

PRESENTATIONS

ADVANCES IN THERMOPLASTIC COMPOSITES

LONG GLASS FIBER POLYPROPYLENE TECHNOLOGY FOR AUTOMOTIVE APPLICATIONS

Jeroen Van Poucke
Dow Automotive
The balance of properties offered by LFRT materials may allow substitution of engineered resins like PC/ABS blends, ABS, SAN, and SMA to lower cost options like polypropylene. Mechanical properties for the various LGF processes and the impact of additives on performance are reviewed.

BEYOND POLYPROPYLENE - LFRT MATERIALS FOR STRUCTURAL, CONDUCTIVE, AND SPECIALTY APPLICATIONS

Tim VanAst
Ticona Engineering Polymers
LFRT-PP is commonly accepted as the material of choice for automotive structural carriers and similar components, yet other applications may require higher performance levels or special functionality. Case studies are presented, highlighting the benefits of products such as LFRT-PA and LFRT-PU.

CONTROL OF MOISTURE & VOLATILE ORGANIC COMPOUNDS BY SORBENT-LOADED COMPOSITES

Paul Koch
Penn State University - Erie
Performance of sorbent-loaded composites is evaluated from the standpoint of 2 distinct design targets: removal the target vapor from the contained environment and reduction of the rate of ingress from the external environment. The concepts of the layer reactivity, the adsorptive capacity, and the sorption rate are applied to the homogeneously reactive media and the sorbent-loaded polymer composites.

PUSHTRUSION™ NEW DIRECT IN-LINE COMPOUNDING TECHNOLOGY - INTEGRATING NEW TECHNOLOGY WITH STATE-OF-THE-ART PRODUCTION SYSTEMS

Eric Lee
PlastiComp LLC
Direct in-line compounding processes reduce the costs of LFRT materials and molding compared to compounds. A disruptive technology has been developed that can be directly adapted to existing injection-molding machines to produce LFRT parts from various engineering resins and a range of reinforcements.

ADVANCED INTEGRATED DOOR SYSTEMS – PROVIDING PERFORMANCE-DRIVEN SOLUTIONS FOR MATERIALS SELECTION & INTEGRATION

Jason Lipke
Ticona Engineering Polymers
Due to the level of integration and structural performance offered, LFRT-PP materials are excellent candidates for door module plates. An overview of door module integration and trends is presented, along with case studies highlighting two recent door module successes.

NEW COMPOSITE SOLUTIONS FOR AUTOMOTIVE UNDERBODY SYSTEMS

Harri Dittmar
Quadrant Plastic Composites AG
As underbody closure systems have proliferated, different materials and process development programs have been commercialized. Although no single material/process meets all OEM needs for cost, drag reduction, undercarriage protection, and noise reduction, three key technologies have emerged that combined meet these criteria.

NEW GENERATION OF HYDRAULIC PRESSES FOR EFFICIENT LFT-D PART PRODUCTION

Manfred Brümmer
Dieffenbacher North America, Inc.
The integration of a new energy-saving high-precision hydraulic press technology leads into an economic manufacturing cell for advanced part manufacturing of LFT components. This will be introduced together with the latest state-of-the art regarding extrusion technology for visible parts.

PRESENTATIONS

BIO- AND NATURAL-FIBER COMPOSITES

INJECTION MOLDED POLYLACTIDE (PLA) COMPOSITES FOR AUTOMOTIVE APPLICATIONS

Angela Harris
Ford Motor Company

Polylactide (PLA) is a biodegradable, compostable, thermoplastic polymer produced from corn. The composition, physical properties, and injection molding process conditions of PLA composites for automotive interior applications are reviewed.

POLY(LACTIC ACID) NANOCOMPOSITES: FABRICATION, MICROSTRUCTURE & PERFORMANCE

Johanne Denault
National Research Council Canada

The preparation of nanoclay-reinforced poly(lactic acid) (PLA) nanocomposites by means of melt processing is discussed. X-ray diffraction and other analytical techniques were used to characterize the dispersion of the nanoclay, the crystalline structure, and the mechanical behavior of the PLA nanocomposites. The relationship between formulation, structure, and performance is discussed.

USE OF AGRICULTURAL MATERIALS IN FLEXIBLE POLYURETHANES FOR AUTOMOTIVE APPLICATIONS

Cynthia Flanigan
Ford Motor Company

The use of soy-derived materials in SMC and polyurethane foams is reviewed. Composite reinforcements of continuous hemp fiber, non-woven hemp mats, fiberglass, and hybrids (fiberglass / continuous hemp twine mixtures) are examined. Foam formulations have been optimized for mechanical and processing performance, including a novel, low-odor method to functionalize soybean oil.

THE USE OF FUNGAL TREATMENT FOR MODIFICATION OF INDUSTRIAL HEMP FIBRE FOR USE IN COMPOSITES

Kim Pickering
University of Waikato, New Zealand

The use of fungi to treat hemp fiber to create better bonding characteristics in natural-fiber reinforced polypropylene composites is reviewed. Physical properties using various analytical techniques are discussed. Increases in tensile strength and thermal stability have been demonstrated.

HEMP FIBRE REINFORCED POLYPROPYLENE COMPOSITES: EFFECT OF FIBRE TREATMENT AND COUPLING AGENT ON COMPOSITE STRENGTH AND FIBRE / MATRIX INTERFACIAL BONDING

Gareth Beckermann
niversity of Waikato, New Zealand

This paper details various techniques to improve composite tensile strength and fibre / matrix interfacial bond strength by means of fibre treatment and coupling agents in hemp-fiber composite systems. Significant improvements have been documented and are reviewed.

WOOD & FLAX FIBRE POLYOLEFIN COMPOSITES

Johanne Denault
National Research Council Canada

Natural fiber and wood composites based on neat and recycled polypropylene (PP) are discussed. The reinforcements were in the form of natural fibers like banana, flax, rice husk and palm fibers, and of wood sawdust. The tensile, flexural, and impact performance were characterized and all composites showed superior mechanical properties when compared with the neat matrix.

CURRENT STATUS OF HIGH VOLUME PRODUCTION OF ENVIRONMENTALLY FRIENDLY MULTIFUNCTIONAL BIOCOMPOSITES: AN OVERVIEW (ORAL ONLY)

Manjusri Misra
Michigan State University

There is a growing interest in the use of natural / biofibers as reinforcing components for thermoplastics and thermoset matrices. This presentation discusses high-volume processing of structural biocomposites with particular focus on extrusion, injection molding, compression molding, sheet molding compounding, and resin transfer molding processing.

PRESENTATIONS

NEW COMPOSITE MATERIALS AND PROCESSING

OEM QUALITY CFRP PARTS

Martin Starkey
Gurit
Affordable lightweight body structures (ALBOS) containing carbon fiber are discussed with a detailed description of the Aston Martin DB9 carbon-fiber composite hood. The composite structure, tooling, manufacturing process, and economics are reviewed.

BMC - TAKING AUTOMOTIVE COMPOSITES TO A NEW DIMENSION

Brett Weber
Bulk Molding Compounds Inc.
New underhood applications of BMC composite materials are discussed including: electronic throttle controls (ETC), air control valves (ACV), and transmission components. Technical comparisons are made between BMC composites and traditional underhood materials.

NEW DEVELOPMENTS IN PUR COMPOSITE SPRAY MOLDING PUR-CSM TECHNOLOGY FOR MULTIPLE PROCESSES

Jim Riley
Bayer MaterialScience LLC
Two new polyurethane composite spray molding (PUR-CSM) techniques are discussed. The Multitech system allows for multi-layered composite constructions. The Baypreg system utilizes a honeycomb core covered with fiberglass mat to produce lightweight, ultra-high-strength parts.

EMI SHIELDING SOLUTIONS USING STAINLESS STEEL FILLED THERMOPLASTIC COMPOSITES

James Fagan
General Electric Plastics
The theoretical and practical applications of melt-processable stainless-steel filled thermoplastic composites are reviewed. These composites are effective electromagnetic shields. Shielding models, product performance features, along with design and processing information critical to achieving effective shielding are discussed.

INNOVATIVE, HIGH STRENGTH GLASS MICROSPHERES FOR LIGHTWEIGHT INJECTION MOLDED PLASTICS & COMPOSITES

Andrew D'Souza
3M Company
High-strength, low-density glass microspheres have been developed and commercialized for use with injection-molded plastic parts and pressed composite structures. Potential application benefits for injection-molded plastic parts containing glass microspheres will be discussed and include lower weight, improved thermal expansion properties, improved processing and improved dimensional stability (less warpage and sink marks).

SMC PREMIUM CLASS A PARTS - INNOVATION IN PROCESS TECHNOLOGY

Frank Henning
Dieffenbacher GmbH
A number of advancements have been made in Europe in SMC formulation and molding. These include the implementation of full automation in the molding of exterior body panels, the development and application of an advanced carbon-fiber SMC, and the adaptation of in-line compounding and molding to the SMC process.

REACTIVELY PROCESSED POLYAMIDE-6 STRUCTURAL COMPOSITES FOR AUTOMOTIVE APPLICATIONS

Kjelt van Rijswijk
Delft University of Technology
Anionic polyamide-6 (APA-6) has been developed for small to midsize production of structural parts. The polymerization, composite structure, physical properties, and comparisons to traditional polyamide 6 systems are reviewed.

HPPC: THE DEVELOPMENT OF A THERMOPLASTIC SOLUTION FOR AUTOMOTIVE HORIZONTAL BODY PANELS

Derek Buckmaster
GE Plastics
A high-performance thermoplastic composite (HPPC) material has been developed for horizontal Class-A body panels. HPPC is comprised of a glass fiber composite core with a reinforced thermoplastic skin and is paintable via conventional techniques.

PRESENTATIONS

STRUCTURAL COMPOSITE APPLICATIONS

A Modular Automotive Roof System Design Concept Based on Polyurethane Composite Technology

Dave Rocco
Bayer MaterialScience LLC
Based on a standard "body in white" roof structure, innovative concepts use molded polymers and composite materials that allow a vehicle to be fitted with a wide variety of roof "modules," each having customized performance, content, and value. A case study looks at the advantages provided by a long-fiber polyurethane-composite-based roof module.

Carbon Fiber Composites for Improved Performance of the Murcièlago Roadster

Paolo Feraboli
University of Washington
Roadster versions rarely handle as crisply, or ride as well as the coupe cars from which they are derived. To compensate for the absence of a roof structure, the Lamborghini Murcièlago roadster incorporates advanced carbon-fiber composites in the monocoque and subframe without a weight or performance penalty.

Material Selection for Front-End Carriers

Craig Dlugos
Ticona Engineering Polymers
Long fiber reinforced thermoplastics (LFRT) offer advantages over metallic options in the design and manufacture of automotive front-end carriers. Mechanical requirements for such systems are presented, along with property profiles on several LFRT systems and case studies of successful implementation.

Design, Fabrication & Testing of a Composite Side Door for a Mid-Size SUV

John Owens
General Motors
As part of a mass-savings initiative, a composite-intensive side-door project was initiated. Prototype doors were molded using vacuum-assisted resin transfer molding. The resulting composite door met the stiffness targets and yielded a 35% mass reduction vs. its steel counterpart.

Toward the Development of a Test Method for Characterizing the Energy Absorption of Composite Materials

Paolo Feraboli
University of Washington
One of the key factors preventing the widespread adoption of composites in primary crash-resistant structures is the absence of specialized test methods for the characterization of specific energy absorption. This presentation reviews and identifies the most promising crush-test methodologies.

Design and Structural Performance Assessment of a Composite Intensive Passenger Vehicle

Hannes Fuchs
Multimatic Engineering Services Group
Development of a modular composite-intensive vehicle (CIV) concept, including closures and suspension, suitable for production volumes of 50,000 per year was completed. Styling, safety, structural stiffness, and material selections are reviewed and assessed.

Non-Class-A Composite Components for the Current North American Automotive OEM Environment (Oral Only)

Will Chan
Sparta Composites
The Ford GT inner decklid is an example of an application that benefited from design and material freedoms due to its non-Class-A nature. Other technologies that can produce advanced composite components achieving lower overall vehicle weight, while mitigating the risks of material availability or cost increases are reviewed.

Hybrid Composite Instrument Panel Cross Car Beam (Oral Only)

Ed Wenzel
Delphi Corporation
An instrument panel cross-car beam system has been developed that utilizes the advantages of both metal and thermoplastic composites to deliver the optimum combination of performance, cost, and packaging. Thermoplastic composites integrate HVAC ducting and case components, wiring channels, safety systems, and attachment features without compromising serviceability.

Presentations

Enabling Technologies

Fiber Length Measurement in LFRT Materials: Using Automated Image Analysis

Jacqueline Ayotte
Ticona Engineering Polymers
Understanding fiber length distribution in LFRT materials can be used to achieve quality, desired mechanical properties, and optimal process control. An automated procedure to measure fiber length accurately and reproducibly has been developed using high-precision motorized stages, high-resolution cameras with automatic imaging, and new image-analysis software capabilities.

Stabilisation of Polymer Matrix Polypropylene in LFT & New Directions

Paul Stassen
AddComp
There are many opportunities for innovations as new properties for G-LFT and D-LFT (PP) materials are required, such as low odor, low VOCs, and low emissions. Various stabilizer packages are mentioned that will allow these properties to be achieved.

Tool Surface Heating Technology - Electromagnetic Transfer between an Inductor and an Electrical Conductive Material Conducting Body of Electricity

Jose Feigenblum
RocTool
Nothing is magic with induction; all phenomena brought into play like Electromagnetic and Thermic are quantified and modelized accurately.

Method of Assembling a Vehicle and Integrated Composite Roof Module Technology - Paradigm Shift in Automotive Vehicle Assembly

Boney Mathew
Mathson Industries, Inc.
A new method of assembling a vehicle and integrated roof module is presented. An efficient and economical method results by attaching the completely assembled roof panel to the vehicle body as the last sequential step when all interior components have been installed on the assembly line.

Non-Destructive Testing the Integrity of Helicopter Blades Utilizing a Unique Corona Beam Technology (Oral Only)

Greg Gormley
ConverTec Corporation
Corona beam technology can be used to characterize and test the integrity of many types of non-conductive materials and items. Anomalies and their location, such as thickness, cracks, stress fractures, pinholes, un-catalyzed resin, molecular structure, contamination, tortuous path holes, fissures and others can be detected, identified and positioned. Use of this non-destructive technology is shown on a helicopter blade.

Enabling Design Innovation in Automotive Composite Applications

Olivier Guillermin
Vistagy, Inc.
The ingredients of the Renault F1 Team's unique success in composites design are presented. Actual design freedom, domain expertise, and excellence in the mastering of composites complexity can be leveraged to develop innovative solutions that unlock the potential of composites for advances in real world practical automotive engineering.

Improving Productivity & Safety with Robotic Trimming

Paul Schuch
Robotic Production Technology
Reasons why composites manufacturers modernize their facilities with robotic trimming systems are presented. Details of how efficiency, safety, cost, and quality are improved are discussed and some in-production cases are presented.

Continuous Fiber Thermoplastic Composites Impact on the Composite Industry

Ed Pilpel
Polystrand
Over the last 25 years, thermoplastic composites have become more widespread and a 'new" industry within composite materials has emerged. New processing and molding developments for continous-fiber thermoplastic composites have led to an impressive increase in the use of these materials.

PRESENTATIONS

SIMULATION AND TESTING OF COMPOSITE MATERIALS

FINITE ELEMENT MODELING OF COMPOSITE TUBULAR CRASHSTRUCTURES WITH AN EXPLICIT CODE

Bronwyn Fox
Deakin University, Geelong, Australia

A phenomenological finite-element modeling methodology is presented that focuses on accurately considering the experimentally observed failure mechanisms typical of the splaying mode of failure exhibited in continuously reinforced composites.

MEASUREMENT OF STATIC AND DYNAMIC FRICTION ENERGY ABSORPTION IN CARBON/VINYL ESTER COMPOSITE

Thomas Brimhall
Altair Engineering

The specific energy absorption (SEA) of composite structures under crush loading has been observed to decrease under dynamic compression compared with quasi-static compression. Corner splitting, delamination, matrix damage and sliding friction were considered in accounting for this decrease in dynamic SEA.

DYNAMIC ENERGY ABSORPTION MODES OF BRAIDED CARBON/VINYL ESTER COMPOSITE CRUSH TUBES

Thomas Brimhall
Altair Engineering

An innovative strip testing fixture was developed to experimentally separate the sliding friction specific energy absorption (SEA) from the SEA due to matrix damage. Strips of braided carbon/vinyl ester composite were testing statically and dynamically, and sliding friction SEA was found to be lower when loaded dynamically compared to quasi-statically.

CREEP AND FATIGUE OF LONG GLASS REINFORCED POLYPROPYLENE COMPOUNDS

Peter Foss
General Motors

This study presents creep and fatigue characteristics of several long-glass reinforced polypropylene compounds that have been used in the development of a thermoplastic liftgate. Both creep and fatigue data show stress levels should be limited to 30% of the failures strength at the maximum-use temperature.

DESIGN AND PROCESS SIMULATIONS OF LONG FIBER THERMOPLASTIC BATTERY BOX DOOR FOR MASS TRANSIT APPLICATION

Uday Vaidya
University of Alabama Birmingham

The current work focuses on a mass-transit bus battery-box door that replaces an existing metal frame door. The part was modeled for stress analysis using ANSYS™; CADpress for Thermoplastics® software was used to predict the part filling, fiber distribution, preferential orientation, shrinkage and warpage, for different temperatures, pressures, and charge placements.

PRESENTATIONS

NANOCOMPOSITES

MULTIFUNCTIONAL POLYPROPYLENE NANOCOMPOSITES REINFORCED WITH EXFOLIATED GRAPHITE NANOPLATELETS (XGNP) (ORAL ONLY)

Hiroyuki Fukushima
Michigan State University
Exfoliated graphite nanoplatelets were added to polypropylene and the mechanical, thermal, and barrier properties as well as the electrical conductivity and percolation threshold were investigated. The relationship between the processing conditions and the resultant properties will be discussed.

DEVELOPING POLYMER NANOCOMPOSITES FOR AUTOMOTIVE APPLICATIONS

Patricia Tibbenham
Ford Motor Company
Potential applications for clay nano-reinforced TPO and carbon nano-reinforced SMC are explored. Techno-economic considerations, including mechanical, thermal and paint performance are compared against part requirements in a business case analysis.

NYLON NANOCOMPOSITE (NANOSEAL™) FOR IMPROVED FUEL PERMEATION PERFORMANCE

Paul Kennedy
Nylon Corporation of America
A novel, specialty engineered nylon (PA) nanocomposite has been designed to enable fuel tank and hose manufacturers to meet the California (CARB) and EPA requirements for fuel permeation. The material processes like neat PA6 and can be run on existing equipment with no modifications.

FORTE: LATEST DEVELOPMENTS IN NOBLE'S BREAKTHROUGH PRODUCT LINE (ORAL ONLY)

Tim Patterson
Noble Polymers
Experiences in combining polypropylene with glass fillers and nanoclay in terms of synergistic effects and resultant physical characteristics of the compounded resins are presented. Improvements in thermal oxidative stability, flexural modulus, and higher impact nanocomposite resins as well as automotive applications are reviewed.

CARBON NANOTUBES: AN ADDITIVE WITH MULTIFUNCTIONAL PROPERTIES & CURRENT COMMERCIAL APPLICATIONS

Andrew Rich
Nanocyl SA
Single and multi-wall carbon nanotubes are reviewed and their effect on the properties – including electrical, fire retardance, and strength – of various resin systems are discussed. Applications, within and outside automotive, where carbon nanotubes are being used or developed are presented.

NOVEL COMPOSITE TECHNOLOGIES

HIGH PERFORMANCE THERMOPLASTIC COMPOSITES (ORAL ONLY)

Fred Deans
Azdel, Inc.
Recent developments in material compounding, processing, and product mix have led to new applications for "long-fiber" thermoplastic composites such as low-density GMTs and LFTs. Now, high-glass-density thermoplastic tapes are being developed for lightweight, high-productivity composites that offer even higher performance in order to compete against traditional thermoset composites used in the aircraft and transportation industries.

INNOVATIVE USE OF THERMOPLASTIC FILM ADHESIVES IN AUTOMOTIVE AIRBAGS

HansJoachim Studt
Collano Xiro GmbH
A newly developed multi-layered thermoplastic composite film for use in side-curtain airbags is presented. This new multi-layered film, which can be a thinner substitute for silicone, provides excellent friction and airproof properties, meeting the requirements of side-curtain airbags without the drawbacks of the current silicone layers of 90g/m2 or more.

APPLICATION OF FIBRE ASSEMBLIES AS DAMPING ELEMENTS IN AUTOMOTIVE INDUSTRY

Elaheh Ghassemieh
University of Sheffield, UK
This study characterizes the damping properties of nonwoven materials with potential applications in the automotive and aerospace industries. Nonwovens are known to be efficient energy absorbers for acoustic damping and ballistic impacts, and this work investigates their behaviour for absorbing dynamic load and mechanical vibrations.

NEW TEXTILE COMPOSITES WITH THERMO-REGULATING PROPERTIES FOR AUTOMOTIVE INTERIOR APPLICATIONS

Barbara Pause
Textile Testing & Innovation, LLC
Textile composites with thermo-regulating properties provided by phase-change materials are introduced with specific solutions for applications in car seats, headliners, and instrument panels.

A NOVEL ORGANIC FIBER FOR FIBER REINFORCED STRUCTURAL COMPOSITES

David Smith
Dpi Technology Consultants Inc.
A novel fiber in the form of poly vinyl alcohol (PVOH) is being developed for the fiber reinforced composites industry for the exceptional impact resistance, surface finish, and improved recycling properties it provides when added to conventional fiber-reinforced composites.

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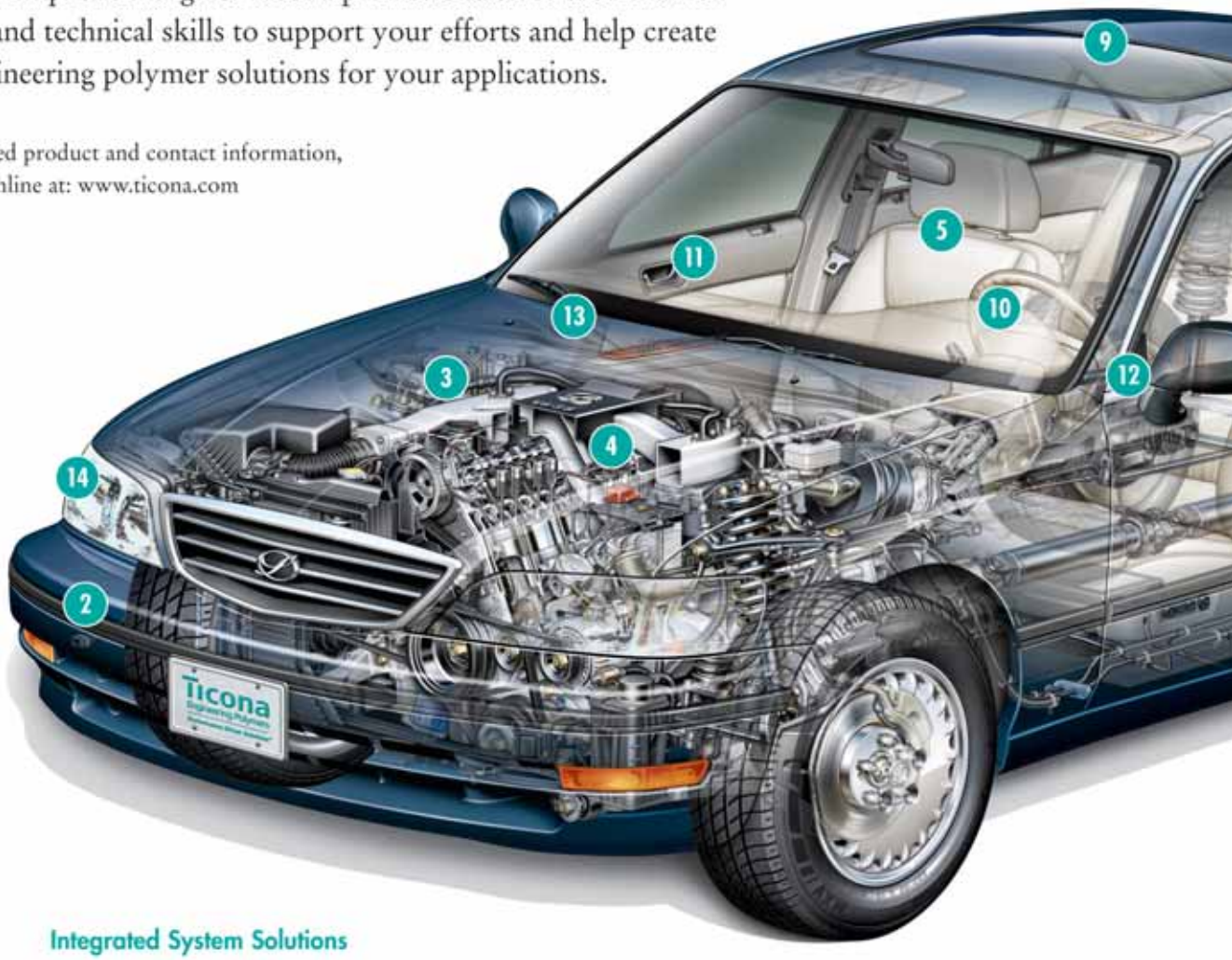

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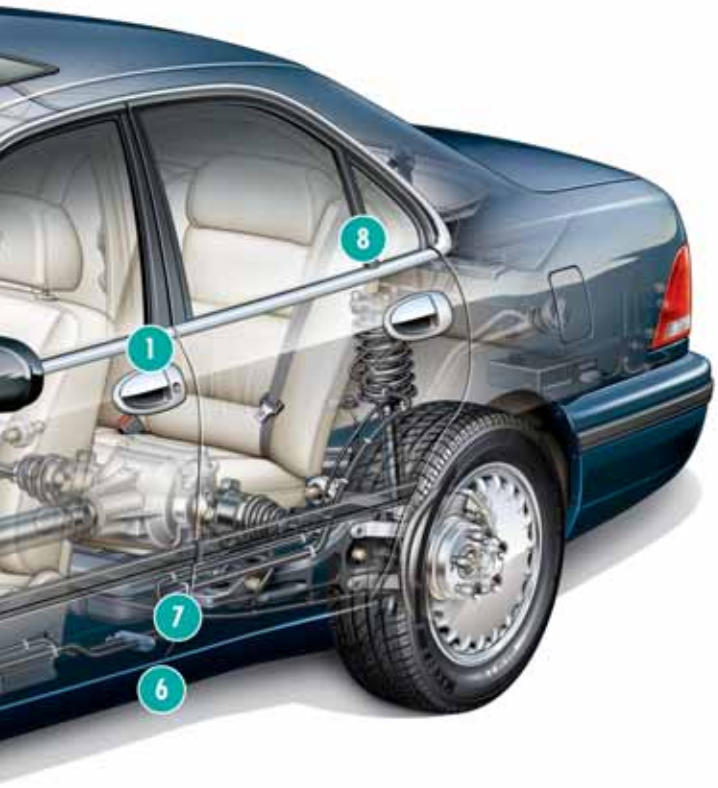

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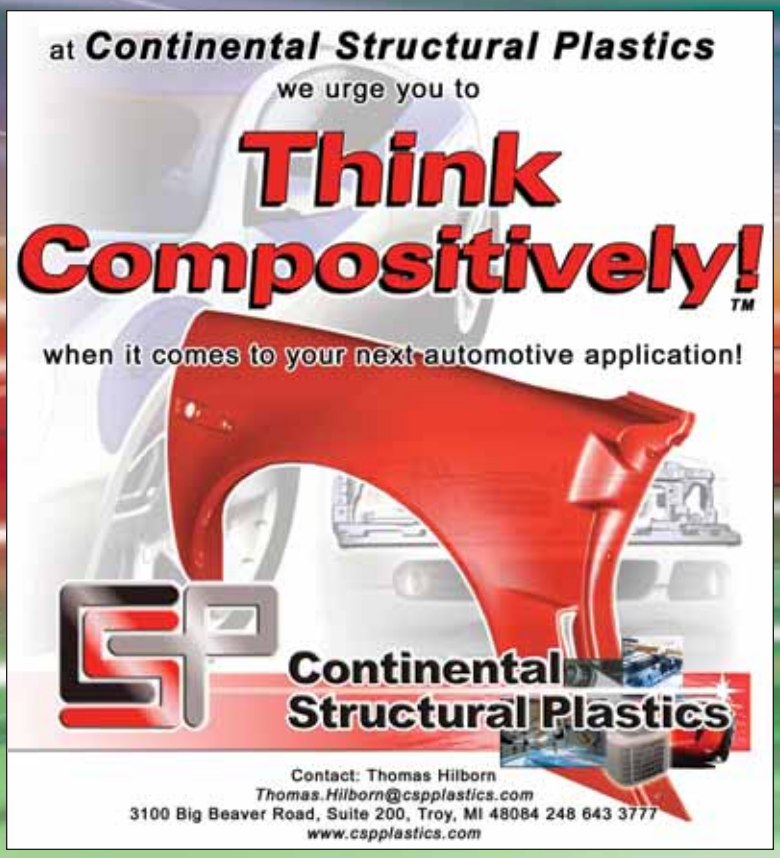

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